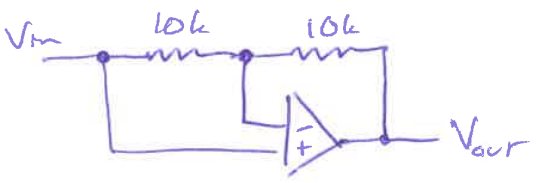
ProSlm 4.4

A)



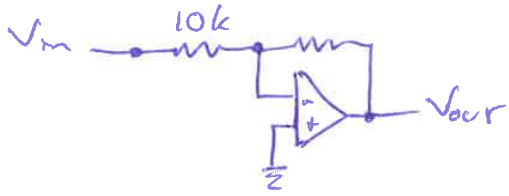
$V_+ = V_{in} = V_-$

so $V_{in} - I R_1 = V_{in}$ so $I = 0$

so $V_{in} - I R_2 = V_{out}$

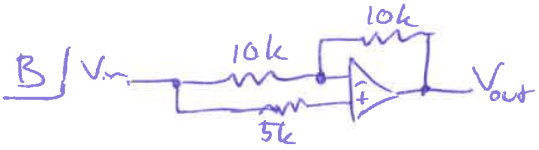
so $V_{out} = V_{in}$

or...



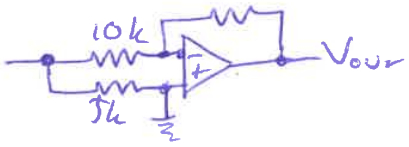
inverter...

B)



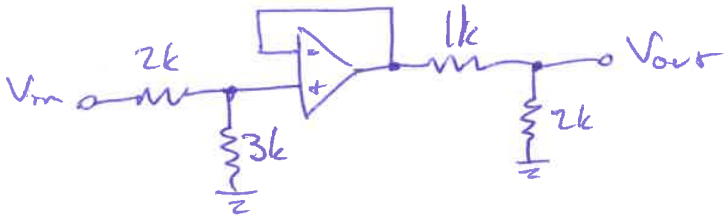
V_+ draws no current... so

$V_+ = V_{in} = V_- = V_{out}$ - follower



$V_+ = 0$ so just inverter again

Op Amp handout ProSlm



$$V_+ = \frac{3}{3+2} V_{in} = \frac{3}{5} V_{in} = V_-$$

$$V_{out} = \frac{2}{2+1} V_- = \frac{2}{3} V_- = \frac{2}{3}\frac{3}{5} V_{in} = \frac{2}{5} V_{in}$$

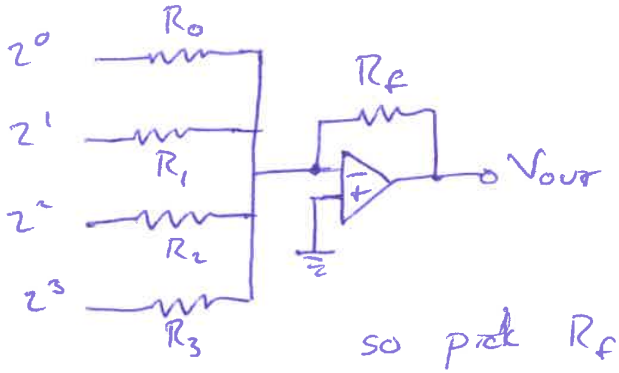
if $V_{in} = 10V$

$V_{out} = 4V$

Problem 4.6

First 1 digit digital to analog

+1V is on, 0V off



$\frac{R_f}{R_0} = 1 \quad \frac{R_f}{R_1} = 2 \quad \frac{R_f}{R_2} = 4 \quad \frac{R_f}{R_3} = 8$

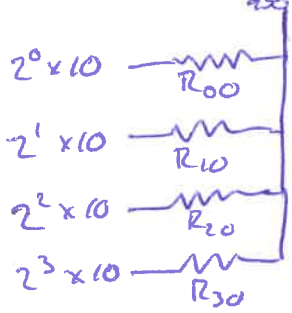
so pick $R_f = 8k$

then $R_0 = 8k \quad R_1 = 4k \quad R_2 = 2k \quad R_3 = 1k$

Now 2 Digit digital to Analog (need to reduce by factor of 10 to stay within +15V supply of opamp)

same as above, but 4 additional inputs

above inputs to op-amp and R_f if $R_f = 8k$ still



$\frac{R_f}{R_0} = 0.1 \quad \frac{R_f}{R_1} = 0.2 \quad \frac{R_f}{R_2} = 0.4 \quad \frac{R_f}{R_3} = 0.8$

$\frac{R_f}{R_{00}} = 1 \quad \frac{R_f}{R_{10}} = 2 \quad \frac{R_f}{R_{20}} = 4 \quad \frac{R_f}{R_{30}} = 8$

$R_0 = 80k \quad R_1 = 40k \quad R_2 = 20k \quad R_3 = 10k$

$R_{00} = 8k \quad R_{10} = 4k \quad R_{20} = 2k \quad R_{30} = 1k$

Now 1 digit to Analog where on is +5V instead of +1V like Problem 4.6

$\frac{R_f}{R_0} = \frac{1}{5} \quad \frac{R_f}{R_2} = \frac{2}{5} \quad \frac{R_f}{R_3} = \frac{4}{5} \quad \frac{R_f}{R_4} = \frac{8}{5}$

if $R_f = 8k$ still

$R_0 = 40k \quad R_1 = 20k \quad R_2 = 10k \quad R_3 = 5k$